

## Dorsey, Nancy

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**From:** Dorsey, Nancy  
**Sent:** Wednesday, April 08, 2015 11:15 AM  
**To:** Charles Lord; 'Holland, Austin A.'  
**Subject:** FW: from DOE Dustin Cranfield webinar on Ohio and Oklahoma seismicity yesterday  
**Attachments:** Earthquakes Induced by Hydraulic Fracturing in Poland Township Ohio.pdf

Hi Austin,

I assume you are already familiar with all of this, but just in case.... We were allowed to sit in on a DOE webinar yesterday, before and overlapping the one you were in with AGI. Most was real seismological analysis slightly toned down for a wider audience. My notes may perforce have some errors based on my understanding, but I jotted down the bits I found fascinating and/or useful.

I know you are beyond busy, but your thoughts are always welcome!  
Nancy

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**From:** Dorsey, Nancy  
**Sent:** Wednesday, April 08, 2015 11:10 AM  
**To:** R6 6WQ-SG; Bates, William; Hildebrandt, Kurt  
**Subject:** RE: from DOE Dustin Cranfield webinar yesterday

Some of my notes from the meeting:

The system uses earthquake recordings from three good quality (modern) seismometers to do the template matching technique, based on the monitor locations in relation to the larger magnitude 'type' source. It can be used to compile probably earthquakes from 0.8 to 2.0 that are frequently missed. The key is the repeating signatures (S and P wave) of numerous low magnitude events, above the signal to noise ratio.

You may thank Bill Bates for the article!

The analysis linking the 'swarmy' earthquakes to hydrofracs show a correspondence from the Frac Focus times to earthquake events from minutes to less than an hour. Generally the events are within 300 to 400 meters laterally and 500 meters vertically. This is where the pressure front versus fluid movement discussion came in. One of the folks chimed in with information from the Decatur CO2 project that should an increased pressure front in less than an hour at a monitor well at the same depth 1000' away.

Bill Bates has requested the article by Friberg et al, 2014 on the Harrison County, Ohio HFs. There were around 2000 events collected from the network down to -1M.

There was also discussion on tracking events related to the Trumbull County, OH disposal well, 10 km from the Northstar (Youngstown quake) well.

In Ohio the optimal oriented strike-slip basement faults **and their conjugate pairs within 30 degrees of the maximum horizontal stress** moved. For the most part these 'swarmy' groups did not start with a large event.

The power law function is related to tectonic fault activity (natural) using a plot of magnitude versus frequency. (Plus a whole lot of other comparisons pre-plot, no doubt.)